

BELLCOMM, INC.

955 L'ENFANT PLAZA NORTH, S.W.

WASHINGTON, D. C. 20024

SUBJECT: Joint Trip Report: Visits to BTL
at Whippany to Discuss Laser-
Atmosphere Experiment, and at
Murray Hill to Discuss Solid State
High Energy Particle Detectors
Case 234

DATE: March 12, 1969

FROM: F. G. Allen
W. A. Gale
L. Kaufman

ABSTRACT

The authors discussed two subjects with Bell Telephone Laboratories groups: 1) a laser experiment on atmospheric propagation to be conducted by BTL with a CO₂ laser on the ATS-F synchronous satellite in 1972; and 2) large solid-state particle detectors that could be used in high energy physics experiments in space.



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MEMORANDUM FOR FILEA. BTL at Whippany, New Jersey

On March 4, the authors met with H. G. Cooper, R. L. Abrams, and M. Subramanian of Jack Cook's Division at Bell Telephone Laboratories in Whippany, New Jersey. The purpose of the meeting was to investigate possibilities for the use of lasers in remote sensing of meteorological variables, and in particular whether their planned experiment in laser light propagation might give the type of information on the atmosphere that meteorologists could use for later operational techniques.

The propagation experiment is planned for the ATS-F satellite in synchronous orbit, for April, 1972. The carbon dioxide laser operating CW at 10.6 microns will have .1 watts of power, and a beam width of 0.01° . A ground beacon and satellite receiver and servo-controlled mirror will maintain the beam pointing. One thousand hours of operating time in the first year will be shared equally with a NASA/GSFC laser communication experiment. BTL is funding the development of the ground equipment which will probably be an optical interferometer with two 20 cm Cassegrain telescopes with variable separation up to 5 meters. The coherence length, attenuation, and scintillation spectrum will be measured.

Some experimental possibilities of interest are frequency shifting the laser from the line center by up to 30 MHz, and moving the beacon to such a point that the direct beam is not received but the forward scattered light is. However, thirty megahertz is only one third of the Doppler line-width (the Doppler absorption line-width of CO_2 at high altitudes) and one two-hundredth of the Lorentz line-width (the pressure-broadened absorption line-width at sea level). Thus the frequency range is not sufficient to obtain vertical profiles of carbon dioxide by absorption measurements.*

*Refer to a forthcoming memorandum on this subject by W. A. Gale.

On the other hand, the total absorption, which will be measured, is expected to vary by up to 10% depending on the temperature and carbon dioxide concentration profile. The coherence length and scintillation spectrum appear to depend on small scale turbulence of the atmosphere, but may depend on large scale conditions as well. The interpretation of the data in terms of large scale variables depends on having meteorological support to provide good vertical profiles of these variables. Provision of suitable meteorological support is currently being looked into.

In conclusion, it appears that certain data of meteorological interest will result from the Whippany experiment if simultaneous measurements can be made of vertical profiles of velocity, temperature, density, carbon dioxide and water vapor.

B. BTL at Murray Hill, New Jersey

On March 4, the authors visited BTL at Murray Hill to discuss the possibility of building large area high spatial resolution particle detectors as originally suggested by V. Perez-Mendez of the Lawrence Radiation Laboratory at

Berkeley. (1) These detectors could be of great significance for a space station high energy physics facility. We talked with Messrs. Walter Brown, Dave Pearson and George Smith. The conclusions drawn by these gentlemen are that the outlook for the use of glassy semiconductors is bleak (this is of course speculative, since few of the critical parameters of these materials are known). On the other hand, the use of amorphous semiconductors such as described in Reference 1 (Mr. Smith mentioned Silicon as being promising), presents some very interesting possibilities. In continuation of this effort, the following steps are now being contemplated:

- 1) to test the properties of glassy semiconductors under transient and d.c. conditions, and
- 2) to obtain amorphous semiconductor layers suitable for testing from BTL or other sources, or
- 3) to find information on manufacturing processes that will allow fabrication at Berkeley.

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REFERENCE

- (1) V. Perez-Mendez, "On the Use of Amorphous Semi-Conductors in Particle Detectors with High Spatial Resolution Over a Large Area," UCID 3319 (February 1969) Unpublished.

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